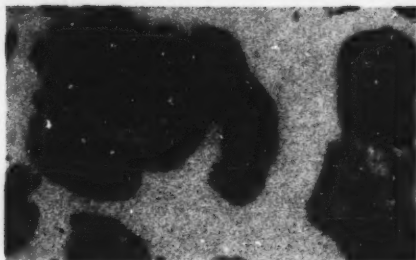


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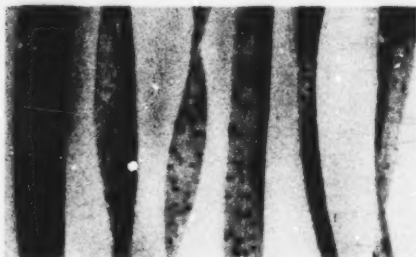
1 An ALGA from turf, after swelling in water.



2 ANTHRACNOSE symptoms on turf of red fescue.



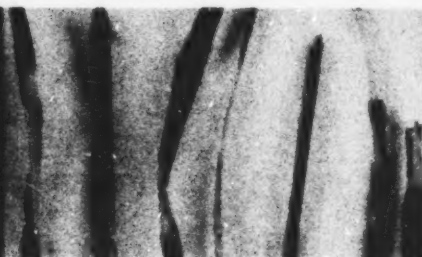
ANTHRACNOSE symptoms on small plants of annual bluegrass.



3 Dark spore masses of BLISTER SMUT in yellowed leaves of Kentucky bluegrass.



4 RHIZOCTONIA BROWN PATCH on fine bent-grass turf.



Bleached lesions on Kentucky bluegrass.



5 SUPERFICIAL FAIRY RING in "Penncross" turf.

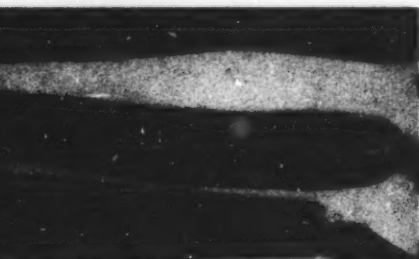


6 MARASMIUS FAIRY RING with stimulated zone and fruits.

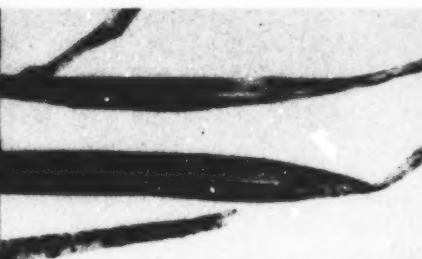
Fruits of *Marasmius oreades* from a fairy ring.



8 MELTING OUT of Kentucky bluegrass turf.



*Drechslera pose* LEAF SPOTS on Kentucky bluegrass.



*Ascochyta sorghi* LEAF BLIGHT on Kentucky bluegrass.



9 PRE-EMERGENCE DAMPING-OFF of fine seedling turf.



11 White POWDERY MILDEW on upper surfaces of bluegrass leaves.

Discoloured under leaf surfaces of POWDERY MILDEW damage.



12 DOLLAR SPOT on "Penncross" bentgrass.

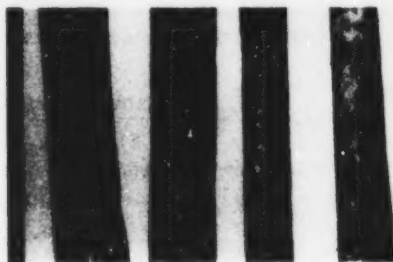


13 RED THREAD: Bleached leaves of red fescue.

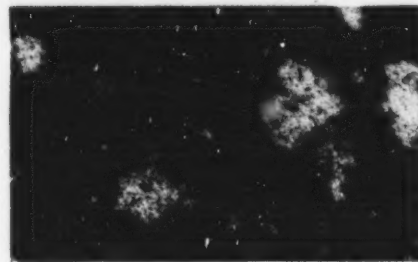
RED THREAD: Pink "needles" of the fungus.



14 Leafy LICHEN in turf.



15 RUST on Kentucky bluegrass.



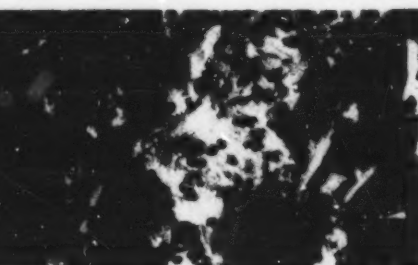
16 FUSARIUM PATCH on bentgrass turf.



17 GRAY SNOW MOULD caused by *Typhula incarnata*.



GRAY SNOW MOULD caused by *T. canadensis*.



*T. canadensis* — mycelium and resting bodies on leaves.



18 SNOW SCALD caused by *Sclerotinia borealis*.

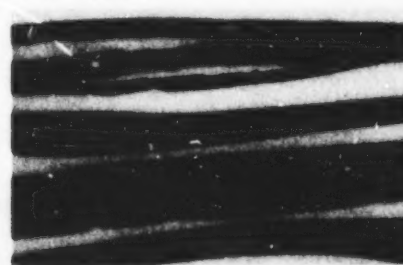


19 LTB SNOW MOULD patches with fringe of mycelium.

SLTB SNOW MOULD at snow melt edge.



20 SLIME MOULD: Spore masses at grass leaf tips.



21 STRIPE SMUT: Lines of dark spores in leaves.



22 TAKE-ALL PATCH in bentgrass: Centre filling with weeds.



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# Major Diseases of Turf Grasses in Western Canada

## Epidemiology and Control

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The most damaging effects of turf grass diseases may often be avoided by good cultural practices such as sound turf establishment, correct fertilization, suitable irrigation, timely thatch removal, adequate soil and air drainage, and snowdrift control. The selection of the most suitable turf grass cultivar or mixture of cultivars is of major importance in minimizing the risk of infection and reducing disease damage. However, the cultivars used are not perfectly adapted to a mown turf environment or to the entire range of climatic conditions that may be met in western Canada.

On the west coast the climate is generally mild, wet, and equable. Most of the Prairies are in the western dry region which extends to eastern Manitoba, with hot dry summers, very cold winters, and lighter snowfall than in eastern Canada. East of Manitoba lies the eastern wet region, for the most part with seasonally well distributed, abundant precipitation. Here the summers are more humid and the snowfall heavier than in the Prairies. But within these greater climatic belts, topography may result in localized climates which differ considerably from the average.

The species of turf grasses which can be used and the range of diseases found, are both determined largely by climate. For example, several different bent grass, fescue, and perennial rye grass cultivars are commonly used in domestic lawns on the west coast. Because perennial rye grass will not survive the prairie winter, lawns there are either of Kentucky blue grass alone or in mixture with creeping red fescue. Bent grasses will not survive in domestic lawns or in golf greens without protection from snow mold attacks, low-temperature injury, and desiccation.

Fungicides are often needed to control both summer and winter diseases. In selecting a fungicide, the fungal pathogen(s) must be identified. It is important to know whether more than one fungus is involved, since some fungicides have a narrow and some a wide range of effectiveness. Often, disease is caused by mixtures (complexes) of pathogens, adverse climatic conditions, and physical and chemical characteristics of the soil. Correct diagnosis is therefore very important.

The efficacy of many fungicides against specific turf grass diseases is known from experimental work in Canada and elsewhere. Although some have had extensive practical usage in other countries, only a limited number of chemicals are registered for certain diseases in Canada. With some materials, registration has been denied or withdrawn because of environmental safety considerations.

Fungicides act most effectively if used to prevent disease and should be applied, if possible, as preventatives before disease appears. Curing a disease already present is more difficult, particularly if plant growth is slowed by unfavorable conditions. Some fungicides act systemically, that is, they are taken up by the plant and act upon the fungus from within; nonsystemic fungicides mainly affect the fungus external to the plant. The usual precautions for storage and use of chemicals should be taken with fungicides. Follow the manufacturer's directions on the label.

For most leaf diseases the recommended dosage of an appropriate fungicide should be applied in 10 to 24 litres of water per 100 square metres. Where a shoot base or root drench is required, double the volume. With some fungicides the margin of safety is small, which emphasizes the need to adhere to the dosage recommended by the manufacturer. Generally, sprays are more effective than dry powder or granular applications.

In Canada, plant protection materials are registered for commercial (C) or domestic (D) use by crop, and disease or pest. Fewer registered turf fungicides are available in Canada than in some other countries. The professional user has a wider range of turf fungicides available than does the domestic lawn owner.

Further information on pests and diseases of lawn grasses:

Fushtey, S.G., M.K. Sears. 1981. Turfgrass Diseases and Insect Pests. Ontario Ministry of Agriculture and Food, 32 pp.

Howard R.J. 1979. "Pests of lawn grasses in Western Canada". *The Greenmaster* 15(3):4-6.

Smiley, R.W. 1983. *Compendium of turfgrass diseases*. American Phytopathological Society. 102 pp.

Smith, J.D. Low-temperature diseases of turfgrasses. In preparation. To be published by Research Branch, Agriculture Canada.

Smith, J.D., Jackson, N. and Woolhouse A.R.W. Diseases of amenity turfgrasses. In preparation. To be published by E & F Spon of London.

Traquair, J.M., Smith, J.D. Diseases and pests of turfgrasses in the Prairie Provinces. Agriculture Canada Bull. (in press).

|   | Disease Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Predisposing Factors                                                                                                                                                                                                                                                                                                                                                                                                           |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | <p>ALGAE, dark green, dark brown or almost black slippery growth may cover lower parts of plants and soil surface in humid conditions. This may dry up to form a crust. Grass is not killed, but growth may be impaired. (see Fig. 1)</p>                                                                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>• over-compaction and soil surface smearing by foot traffic or implements, especially on heavier soils</li> <li>• poor surface drainage</li> <li>• shaded situations</li> <li>• heavy applications of high organic amendments</li> </ul>                                                                                                                                                |
| 2 | <p>ANTHRACNOSE and BASAL ROT (<i>Colletotrichum graminicola</i>).<br/>           (a) Leaves and shoots of grasses, particularly of annual blue grass and fine-leaved fescues are blighted and killed back in irregularly shaped, reddish to bleached patches up to several feet in diameter. May be confused with red thread, but there are no red "needles". Often occurs with leaf spots caused by <i>Drechslera</i> spp.<br/>           (b) Turf of annual blue grass takes on a measly or piebald appearance. Diseased plants turn yellow or orange and central shoots may be pulled out easily and are black at the base. (see Figures 2)</p> | <ul style="list-style-type: none"> <li>• susceptible species and cultivars</li> <li>• high temperatures with high humidity</li> <li>• low soil fertility</li> <li>• compacted turf in high traffic areas</li> <li>• low fertility</li> </ul>                                                                                                                                                                                   |
| 3 | <p>BLISTER SMUT (<i>Entyloma dactylidis</i>) of Kentucky blue grass and other turf grasses. Water-soaked spots appear on lower leaf surfaces. Linear, rectangular or round blisters, measuring 0.1 to 1 mm, are often surrounded by a yellow halo. Blisters darken to almost black and are covered with a lighter skin. May cause considerable damage. Probably more common than reported and overlooked where <i>Drechslera</i> spp. leaf spots are abundant. Found on <i>P. annua</i> in Alaska. Related species are found on red fescue in B.C. (see Figure 3)</p>                                                                              | <ul style="list-style-type: none"> <li>• mild winters</li> <li>• susceptible cultivars</li> </ul>                                                                                                                                                                                                                                                                                                                              |
| 4 | <p>BROWN PATCH (<i>Rhizoctonia solani</i>). A "smoke-ring" of greyish-black mycelium from 1.5 to 4 cm wide develops around an active patch. Attacked grass leaves show dark-bordered lesions, become water-soaked and blackened, collapse, then dry up and become light brown with sclerotia at plant bases. Patches 2 cm to 1 m in diameter may occur in short mown turf. It may progress very rapidly. Mainly in parts of eastern Canada and southern B.C., although a lower temperature form of the disease has been found in the Prairies. (see Figures 4)</p>                                                                                 | <ul style="list-style-type: none"> <li>• all grasses are affected, but some <i>Agrostis</i> cultivars are very susceptible</li> <li>• hot, very humid daytime weather conditions with night temperatures about 18°C</li> <li>• unbalanced nitrogen applications leading to development of lush rapid growth</li> <li>• frequent mowing renders fine turf more susceptible, as the fungus gains entry through wounds</li> </ul> |

| Cultural Control                                                                                                                                                                                                                                                                                                      | Chemical Control                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scarify surface to alleviate problem. Improve soil and drainage. Aerate.                                                                                                                                                                                                                                              | No material registered in Canada.                                                                                                                                                                                                                                                                                                                                                               |
| Use less susceptible cultivars. Highlight, Ensylva, Pennlawn were less susceptible fescues than was Dawson at Agassiz, B.C.                                                                                                                                                                                           | The following materials may be used:<br>* CD Benomyl<br>CD Chlorothalonil<br>CD Maneb                                                                                                                                                                                                                                                                                                           |
| Reduce traffic, increase aeration and relieve compaction by spiking. Improve fertility. Replace annual blue grass with other turf grasses.                                                                                                                                                                            | No registered fungicide available in Canada.                                                                                                                                                                                                                                                                                                                                                    |
| Use resistant cultivars of Kentucky blue grass, or other grass species. At Agassiz, Baron, and Victa were severely infected, but Majestic, Merion, Nugget, and Sydsport showed no disease. Baron was also susceptible in W. Washington. Encourage rapid spring growth by ensuring adequate nutrient and water supply. | No effective fungicide treatment known.                                                                                                                                                                                                                                                                                                                                                         |
| Avoid unbalanced or excessive nitrogen applications particularly where there is a history of the disease. Reduce frequency of mowing. Reduce irrigation, especially late in the day during danger periods.                                                                                                            | Apply suitable fungicide during danger periods in advance of an attack in July to September at 5 to 10-day intervals.<br><b>Registered materials:</b><br>D Anilazine<br>CD Benomyl<br>CD Chlorothalonil<br>** C Iprodione<br>CD Maneb<br>C Mercurous + mercuric chloride<br>C Phenyl mercuric acetate<br>C Phenyl mercuric acetate + thiram<br>C Quintozene<br>C Thiram<br>C Thiophanate-methyl |

\* CD — Commercial and Domestic registration

\*\* C — Commercial registration only

|    | Disease Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Predisposing Factors                                                                                                                                                                                                                                                                                                                                                    |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  | <b>DAMPING-OFF</b> of seedlings, particularly of small-seeded turf grasses ( <i>Pythium</i> , <i>Fusarium</i> , <i>Helminthosporium</i> , or <i>Rhizoctonia</i> species). Seedlings fail to emerge from ground or collapse and rot when emerged. (see Figure 9)                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• cold, too wet or too dry seed bed</li> <li>• seed of low vitality</li> <li>• inadequate soil nutrients</li> </ul>                                                                                                                                                                                                              |
| 6  | <b>DOLLAR SPOT</b> ( <i>Sclerotinia homoeocarpa</i> ). Spots of straw color, roughly circular, recognizable when 1 to 2 cm in diameter with delicate mycelium stretching from leaf to leaf, apparent when dew is present. Individual leaf blades may show both damaged and uninfected sections. Spots may remain discrete to about 7 cm in diameter in fine turf and then coalesce. In longer turf, individual spot margins are not so clearly defined. The disease is common only in eastern Canada, from spring to fall. (see Figure 12) | <ul style="list-style-type: none"> <li>• most grasses are susceptible, but in eastern Canada <i>Agrostis</i> spp. are the species usually infected</li> <li>• low soil fertility</li> <li>• heavy, prolonged dews</li> <li>• uncontrolled infection from previous year</li> <li>• continual use of one fungicide will allow the fungus to develop resistance</li> </ul> |
| 7  | <b>FAIRY RING</b> ( <i>Lycoperdon</i> , <i>Psalliota</i> , <i>Clitocybes</i> species and others) may produce rings or ribbons of green grass, and less frequently, bare zones.                                                                                                                                                                                                                                                                                                                                                             | Occurs even on well-watered turfs, but rarely persists for long periods and rarely disfigures or affects playing surface of greens.                                                                                                                                                                                                                                     |
| 8  | <b>FAIRY RING</b> ( <i>Marasmius oreades</i> ). Ribbons or complete rings of dark green grass with associated bare areas. Tan-colored fruits (toadstools) often found in rings in summer and/or fall. White fungal mycelium with a musty odor in the soil under the ring when active. (see Figures 6,7)                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• more noticeable and damaging in drier locations and light soils, e.g. in lawns on boulevards, cemeteries, golf fairways</li> <li>• not uncommon in native or sown grassland from which domestic lawn soil is often obtained</li> <li>• domestic lawns between 5 and 20 years old are more commonly affected</li> </ul>         |
| 9  | <b>SUPERFICIAL FAIRY RING</b> (various unnamed species) sometimes cause depressed rings. (see Figure 5)                                                                                                                                                                                                                                                                                                                                                                                                                                    | • damage may be more evident to close-mown playing surfaces, especially <i>Agrostis</i> cultivars                                                                                                                                                                                                                                                                       |
| 10 | <b>LEAF SPOTS, FOOT ROTs and MELTING-OUT</b> of Kentucky blue grass (mainly <i>Drechslera poae</i> ; also <i>D. dictyoides</i> — leaf blight of blue grasses and fescues; <i>Bipolaris sorokiniana</i> — leaf spot of most grasses; <i>D. erythrospila</i> — red leaf spot of bent grasses). Found in all regions. Important on Kentucky blue grass on west coast. <i>B. sorokiniana</i> may cause severe seedling blight on sand-based golf greens. (see Figures 8)                                                                       | <ul style="list-style-type: none"> <li>• susceptible cultivars</li> <li>• close mowing</li> <li>• excessive nitrogen</li> <li>• <i>D. poae</i> leaf spotting is favored by wet periods in spring and fall, and excessive irrigation</li> <li>• foot rot and melting-out develop after the leaf spot symptoms</li> </ul>                                                 |

| Cultural Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Chemical Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Use seed of high germination capacity and energy. Prepare a good firm seed bed. Encourage rapid germination — e.g., wait until ground has warmed in spring, or sow before it cools in fall, incorporate organic mulch in surface and apply adequate nitrogen and phosphate before sowing. Keep seed bed moist, but not waterlogged.</p>                                                                                                                                                                           | <p>Seed dressing for pre-emergence damping-off:</p> <ul style="list-style-type: none"> <li>C Captan</li> <li>C Thiram</li> </ul> <p>Post-emergence sprays for severe damping-off:</p> <ul style="list-style-type: none"> <li>CD Benomyl (for <i>Rhizoctonia</i> or <i>Fusarium</i> spp.)</li> <li>C Chloroneb (for <i>Pythium</i> spp.)</li> </ul>                                                                                                                                                                                                                                                                                                         |
| <p>Disperse dew early in the morning by switching, poling or hose-dragging during summer. Reduce barriers to air flow over turf surface and facilitate free drainage. Symptoms may be suppressed by application of nitrogenous fertilizer during summer. Attend to overall soil fertility. Remove clippings which carry infection. Little information on cultivar resistance is available in Canada.</p>                                                                                                             | <p>Where disease is prevalent fungicide applications will be needed from late June to autumn, at 7 to 28-day intervals. Alternate systemic materials with protectants to reduce tolerance developing in fungus. Systemics give longer residual protection than do protectants.</p> <p><b>Registered materials:</b></p> <ul style="list-style-type: none"> <li>D Anilazine</li> <li>CD Benomyl (systemic)</li> <li>CD Chlorothalonil</li> <li>C Iprodione</li> <li>C Mercurous + mercuric chloride</li> <li>C Phenyl mercuric acetate</li> <li>C Phenyl mercuric acetate + thiram</li> <li>C Quintozene</li> <li>C Thiophanate-methyl (systemic)</li> </ul> |
| <p>Mask with fertilizer applications.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>No material registered in Canada.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>For full details see Canadex leaflet No. 273.630 December 1978, <i>Fairy ring biology and control</i>. Apply nitrogenous fertilizer, aerate and irrigate well to mask symptoms. Use "spike and soak" or "disturbance with formaldehyde fumigation" or "complete soil excavation with fumigation" methods. Divide lawn into sections with paths or borders. Rings will grow out against these or against each other and disappear at points of contact. Use mutual inhibition method where rings are abundant.</p> | <p>So far, there is no fungicide registered in Canada which, when applied to the turf surface, may be relied on to eradicate <i>M. oreades</i> rings. Fumigant fungicides are more effective if the infested soil is disturbed and broken up.</p> <p><b>Registered material:</b></p> <ul style="list-style-type: none"> <li>D Formaldehyde</li> </ul>                                                                                                                                                                                                                                                                                                      |
| <p>Mask with fertilizer applications. Water deeply as required.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>No material registered in Canada.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>Raise height of cut, avoid excessive nitrogen and irrigation, use resistant Kentucky blue grass cultivars such as Merion, Bristol, Nugget, Touchdown.</p>                                                                                                                                                                                                                                                                                                                                                         | <p>Control leaf-spotting phase by applications every 7 to 14 days.</p> <p><b>Registered materials:</b></p> <ul style="list-style-type: none"> <li>D Anilazine</li> <li>CD Chlorothalonil</li> <li>C Iprodione</li> <li>CD Maneb</li> <li>C Phenyl mercuric acetate</li> <li>C Phenyl mercuric acetate + thiram</li> <li>C Quintozene</li> </ul>                                                                                                                                                                                                                                                                                                            |

|    | Disease Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Predisposing Factors                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | <p>LICHENS — (Composite organisms of algae and fungi). Low-growing, pale green to dark brown, shrubby, or leafy growth intermingled with grass. Found on poor soils in low to high rainfall areas, particularly on neglected tree-shaded lawns. (see Figure 14)</p>                                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• low fertility</li> <li>• lime-deficient soils may be more prone to attack</li> </ul>                                                                                                                                                                                                                                                                                                                                 |
| 12 | <p>NEMATODES (Root-knot and meadow lesion nematodes). May cause damage in warmer regions. Root-knot nematodes cause swelling and distortion of roots; meadow lesion nematodes cause discolored patches of grass which do not respond to other remedial measures. The distribution and importance of these problems are uncertain.</p>                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• root-knot nematode damage on annual blue grass is sometimes associated with overcompaction of soil and low fertility</li> </ul>                                                                                                                                                                                                                                                                                      |
| 13 | <p>POWDERY MILDEW (<i>Erysiphe graminis</i>). A gray or white coating of mycelium and spores develops on leaves, especially on some cultivars of Kentucky blue grass. Leaves may turn yellow, orange or brown. All regions. Rarely severe on mature turf in Prairies until fall. (see Figure 11)</p>                                                                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>• shaded situations under trees or north sides of buildings, from May to November</li> <li>• first-year seedlings of some Kentucky blue grass cultivars in open situations may be severely damaged</li> <li>• excessive or deficient nitrogen favors disease</li> <li>• cultivars of Kentucky blue grass vary greatly in resistance in different regions, depending on physiologic form of pathogen present</li> </ul> |
| 14 | <p>RED THREAD (<i>Laetisaria fuciformis</i>, formerly <i>Corticium fuciforme</i>). Coral pink to blood-red, branched, antler-like stromata or needles attached to the surface of shoots and leaves. Margins of bleached patches of grasses irregular in outline from a few centimetres to 50 cm or more in diameter. In mild cases blade tips only are damaged, but in severe cases shoots are killed. Common in the cooler, humid regions; rare in Saskatchewan, but has on occasion caused extensive damage to lawns and golf courses in Edmonton, Alberta. A similar disease, called Pink Patch (<i>Limonomyces</i> spp.) occurs mainly on perennial ryegrass. (see Figure 13)</p> | <ul style="list-style-type: none"> <li>• most grass species are attacked, but fine-leaved fescues and perennial rye grasses are often severely damaged</li> <li>• low fertility leading to slow leaf production</li> <li>• favored by moist, cool weather, yet warmer than for fusarium patch</li> <li>• turf may sometimes be infected in cold weather</li> </ul>                                                                                            |
| 15 | <p>RUST (<i>Puccinia poae-nemoralis</i> — brown fleck rust of Kentucky blue grass, also found on other turf grasses; <i>P. recondita</i> — brown or leaf rust on several turf grass species; <i>P. graminis</i> — black or stem rust on several turf grass species). Rusts develop late in most seasons and so are seldom severe on mown turf grass; <i>P. poae-nemoralis</i> is sometimes an exception. Several rust species may seriously damage grass seed crops. (see Figure 15)</p>                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• low fertility, especially in nitrogen towards the end of the growing season</li> <li>• inadequate irrigation</li> <li>• susceptible cultivars as mentioned</li> </ul>                                                                                                                                                                                                                                                |

| Cultural Control                                                                                                                                                                                                                                                                                                                                                   | Chemical Control                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Remove lichen by scarification and follow with appropriate fertilizer and/or lime and aeration.                                                                                                                                                                                                                                                                    | None necessary                                                                                                                                                                                                                 |
| Maintain turf vigor.                                                                                                                                                                                                                                                                                                                                               | If needed, fumigate soil with dichloropropane or dichloropropene before seeding to control nematodes (commercial use only).                                                                                                    |
| Use creeping red fescue for lawn turf in shaded situations rather than Kentucky blue grass. Cultivars of the latter vary in resistance according to prevalence of physiological races but Dormie, Sydsport, and Nugget often show little disease. Flying, and Merion are moderately resistant and Park susceptible. Raise height of cut, avoid excessive nitrogen. | <b>Registered materials:</b><br>C Thiophanate-methyl<br><br>Apply every 10 to 14 days                                                                                                                                          |
| Improve supply of soil nitrogen and relieve deficiency of other nutrients. Control thatch. Use seed mixtures containing a less susceptible species such as Kentucky blue grass.                                                                                                                                                                                    | Apply fungicides, particularly during humid periods from spring to late fall.<br><b>Registered materials:</b><br>D Anilazine<br>CD Chlorothalonil<br>CD Maneb<br>C Mercurous + mercuric chloride<br>C Phenyl mercuric acetate. |
| Where <i>P. poae-nemoralis</i> is a problem avoid the 'Merion' cultivar of Kentucky blue grass. Maintain vigorous grass growth in summer.                                                                                                                                                                                                                          | <b>Registered materials:</b><br>CD Maneb                                                                                                                                                                                       |

|    | Disease Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Predisposing Factors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16 | <p>SLIME MOLDS (<i>Physarum</i> spp.) <i>P. cinereum</i> has lilac-gray globular sporangia, usually less than 1 mm in diameter, cluster and coat grass leaf blades. Later, sporangia burst, liberating brown spores. Common in all regions. Little damage done to grass. (see Figure 20)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>• prolonged periods of wet weather</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 17 | <p>COTTONY SNOW MOLD or LTB (non-sclerotial low-temperature basidiomycete) and SLTB (sclerotial LTB) SNOW MOLDS (<i>Coprinus psychromorbidus</i>). Large patches, occasionally with dense, white cottony mycelial growth at edges (LTB); or small (1-3 mm) brownish-black, irregular sclerotia on leaves and stem bases (SLTB). Often, LTB patches do not coalesce. (see also discussion under Pink Snow Mold). (see Figure 19)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• shallow to deep snow covers</li> <li>• slow melting of drifts in spring</li> <li>• unbalanced, late nitrogenous fertilization</li> <li>• previous attacks</li> <li>• most common turf grass species, e.g., Flying, Nugget, Sydsport, Merion, and Newport Kentucky blue grasses are susceptible</li> </ul>                                                                                                                                                                                                                                                      |
| 18 | <p>GRAY SNOW MOLD. Patches of damaged grass sometimes with superficial gray mycelium — sclerotia in or on plant tissues: (see discussion under Pink Snow Mold)</p> <p>(a) <i>Typhula incarnata</i> — British Columbia and eastern Canada, rare in Prairies — orange to brown sclerotia up to 2 mm. (see Figure 17)</p> <p>(b) <i>T. ishikariensis</i> var. <i>canadensis</i> — the most common <i>T. ishikariensis</i> var. of the deep snowfall areas of western Canada, known as far east as Ottawa. Abundant gray, superficial mycelium — sclerotia brown-black, less than 1 mm. Often occurs with <i>F. nivale</i> on Prairies. (see Figure 17)</p> <p>(c) <i>T. ishikariensis</i> var. <i>ishikariensis</i> — distribution not fully known — deep snowfall areas in western and eastern Canada — less abundant gray mycelium than var. <i>canadensis</i>, sclerotia about 1 mm. Complexes of <i>Typhula</i> spp. with each other and with other snow molds are common.</p> | <ul style="list-style-type: none"> <li>• forced fall growth</li> <li>• most commercially available Kentucky blue grass cultivars are susceptible to <i>T. incarnata</i></li> <li>• most <i>Agrostis</i> cultivars seem to be susceptible to <i>T. i. var. canadensis</i></li> <li>• little information on varietal resistance. <i>T. incarnata</i> does not require long duration snow cover to cause damage</li> </ul>                                                                                                                                                                                 |
| 19 | <p>PINK SNOW MOLD, FUSARIUM or MICRODOCHMIUM PATCH. (<i>F. nivale</i> = <i>M. nivale</i>). In fall usually, but at other cool, damp periods in the year also, small water-soaked patches of brown or yellow-brown grass appear, particularly on <i>Poa annua</i>. After snow melt in spring the patches may turn pink on exposure to light. Found in all regions.</p> <p>In general, snow molds (including pink snow mold, gray snow mold, snow scald and cottony or LTB/SLTB snow molds) are caused by low-temperature tolerant fungi able to grow at temperatures at or below 0°C. (see Figure 16)</p>                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• unbalanced or excessive nitrogenous fertilizer, particularly if applied late in the growing season</li> <li>• alkaline turf surface</li> <li>• high surface moisture</li> <li>• cold, humid weather or early snow in fall</li> <li>• warmth from nearby buildings</li> <li>• susceptible <i>Poa annua</i> and <i>Agrostis</i> cultivars; Kentucky blue grass often attacked, but rarely killed out</li> <li>• deep snow cover provides insulation and high humidity favorable to development of snow mold fungi, and prolongs the periods of attack</li> </ul> |

| Cultural Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Chemical Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| <p>Brushing and mowing of grass when the turf dries will remove sporangia.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>None required, but most fungicides used for other diseases will prevent slime molds and control them when present.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>Control snow cover with fences and spread snow drifts or encourage rapid melting with soot or fine ashes. Control thatch. Tests suggest that unbalanced phosphate applied when turf is dormant in late fall in the Prairies will favour LTB snow mold. Dormie and Park are more resistant than other Kentucky blue grass cultivars. Arctared was most resistant of the red fescue cultivars in Saskatchewan tests. <i>Poa annua</i> turf re-establishes well from seed lying at the turf surface.</p>                                                                                                                                                                                                                  | <p>Unless resistant Kentucky blue grasses are in use, inorganic mercury fungicides may be needed. More than one application should be made, the final one before the development of a permanent snow cover.</p> <p><b>Registered materials:</b></p> <ul style="list-style-type: none"> <li>C Mercurous + mercuric chloride</li> <li>C Oxycarboxin + thiram + carbathiin</li> <li>C Quintozene</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <p>Allow turf to "harden off" in fall in prairie region, as for fusarium patch and LTB. Insufficient information on cultivar resistance for reliable recommendations on <i>Agrostis</i> cultivars. Adorno and Monopoly Kentucky blue grasses are reported to be resistant. Applications of soot, fly ash or other finely ground, dark materials to hasten melting of snow in late winter may reduce severity of snow molds in general.</p>                                                                                                                                                                                                                                                                                | <p>Fungicides should be applied in fall before development of a permanent winter snow cover. In some less snowy regions where <i>T. incarnata</i> is the principal species responsible, only one application of fungicide in late fall may be sufficient. In the Prairies and where <i>T. ishikariensis</i> var. <i>canadensis</i> is involved the disease is less responsive to control by fungicides effective against <i>T. incarnata</i> and several applications may be needed.</p> <p><b>Registered materials:</b></p> <ul style="list-style-type: none"> <li>C Chloroneb</li> <li>CD Chlorothalonil</li> <li>C Iprodione</li> <li>C Mercurous + mercuric chloride</li> <li>C Oxycarboxin + thiram + carbathiin</li> <li>C Phenyl mercuric acetate</li> <li>C Phenyl mercuric acetate + thiram</li> <li>C Quintozene</li> </ul> |
| <p>Let turf "harden off" for winter. Keep mowing into late fall. Rake off fallen leaves. Give adequate, balanced, but not excessive or late fertilizer. Avoid the use of materials which rapidly raise turf surface pH, e.g. lime, or alkaline-tending fertilizers. Open up hedges or dense windbreaks to improve air movement. Replace susceptible cultivars with more resistant ones. Penncross is less susceptible than Seaside bent grass in Prairies and B.C.; creeping bents are less susceptible than brown top cultivars. Control snow cover with fences and spread snow drifts. Encourage rapid melting of snow with applications of soot, fine ashes or other finely ground, dark materials in late winter.</p> | <p>Control disease before turf growth slows down in fall or patches may remain until spring. Depending on region, this may mean that the first fungicide should be applied in late summer. Several applications may be needed preferably of different materials until permanent snow cover develops, especially where complexes occur to reduce the chance of fungicide resistance developing.</p> <p><b>Registered materials:</b></p> <ul style="list-style-type: none"> <li>CD Benomyl</li> <li>CD Chlorothalonil</li> <li>C Mercurous + mercuric chloride</li> <li>C Oxycarboxin + thiram + carbathiin</li> <li>C Phenyl mercuric acetate</li> <li>C Phenyl mercuric acetate + thiram</li> <li>C Quintozene</li> <li>C Thiophanate-methyl</li> </ul>                                                                               |

| Disease Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Predisposing Factors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>20</b>      <b>SNOW SCALD</b> (<i>Myriosclerotinia borealis</i> or <i>Sclerotinia borealis</i>). Patches of dead grass plants with water-soaked leaves and sparse gray fungus appear at snow melt, which then bleach almost white. Black sclerotia 0.5 to about 7 mm long found on leaves and in plant bases. Probably across Canada except in milder climates or low snow regions, but little detailed information except from West. (see also discussion under Pink Snow Mold).<br/>(see Figure 18)</p>                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• most common grasses are susceptible</li> <li>• <i>Agrostis</i> cultivars are sometimes severely damaged in the Prairies, but severe turf damage occurs only in higher snowfall areas or years with long-duration snow cover</li> <li>• endemic on native grasses and cultivated species in ditches and where snow is trapped adjacent to mown turf</li> </ul>                                                                                                        |
| <p><b>21</b>      <b>STRIPESMUT</b> (<i>Ustilago striiformis</i>). Infected leaves show yellow stripes which turn gray and then black. Longitudinal splits develop exposing black spore masses. Kentucky blue grasses are most prone to infection, but bent grasses, fescues and timothies may be infected with different strains. In all western provinces.<br/>(see Figure 21)</p>                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• infested seed</li> <li>• susceptible cultivars, particularly Kentucky blue grass and bent grass</li> </ul>                                                                                                                                                                                                                                                                                                                                                           |
| <p><b>22</b>      <b>TAKE-ALL or OPHIOBOLUS PATCH</b> (<i>Gaeumannomyces graminis</i> var. <i>avenae</i> formerly <i>Ophiobolus graminis</i> var. <i>avenae</i>). Patches with bleached or bronzed margins develop in turf of <i>Agrostis</i> spp. The centres are killed and invaded by broadleaved weeds and other grasses. Grass in patch margins has little root hold. Small, beaked black fungal structures develop at base of shoots in fall. Patches progress in size from 5 cm to 1 m or more in diameter and persist for several seasons. The disease causes serious problems in British Columbia especially on new turf formed on forest or sandy soils. May also be present in eastern Canada since it is present in eastern U.S.A.<br/>(see Figure 22)</p> | <ul style="list-style-type: none"> <li>• while many grasses are attacked, <i>Agrostis</i> spp. are most severely damaged</li> <li>• most common in higher rainfall areas following applications of lime or other alkaline-tending materials which raise the pH of turf surface and upset the microbial balance of the soil</li> <li>• chemical soil sterilization or use of a wide-spectrum fungicide may inhibit antagonistic organisms and allow <i>G. graminis</i> to develop with little check</li> </ul> |

# Photo Credits

R.E. Underwood    Figs. 1, 2a, 3, 4a, 8a, 8b, 11a, 15, 17b, 20, 21

I. Evans            Fig. 13b

J.D. Smith        Figs. 2, 4, 5, 6, 8a, 8, 9, 12, 13, 14, 16, 17, 17a, 18, 19, 19a, 22

Color plates were used courtesy of the University of Saskatchewan

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**Cultural Control**

Spread snow drifts to encourage rapid melting, especially on fine bent grass turf. Control disease on adjacent rougher turf. Seaside less susceptible than Penn-cross bent grass.

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**Chemical Control**

In an "open" fall make two fungicide applications before a permanent snow cover develops.

**Registered materials:**

- C Mercurous + mercuric chloride
- C Quintozene.

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Avoid susceptible cultivars of Kentucky blue grass such as Merion and Common. Use Park where the disease is a problem.

**Registered materials:**

- CD Benomyl
- CD Thiophanate-methyl

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Where the disease is likely to occur, especially on *Agrostis* turf, use an acid-tending top dressing such as ammonium sulphate. Acid materials are usually not necessary on new turf on forest soils in British Columbia. Should soil become too acidic (below pH 5, on samples from the top 2.5 to 5 cm) lime may be needed. Use coarsely ground limestone or shell sand in moderate amounts, based on soil analyses, followed by ammonium sulphate or sulphur to re-acidify the turf surface. Renovate diseased patches with resistant or more tolerant grass species such as fescues or blue grasses.

No fungicide registered in Canada or recommended. Avoid wide-spectrum fungicides and soil fumigants for other purposes where take-all patch is known to be a problem since they may hinder the activities of natural soil antagonists. Applications of sulphur will hasten the re-acidifying process.

# COMMON AND TRADE NAMES FOR FUNGICIDES USED TO CONTROL TURF DISEASES IN CANADA

There are a large number of fungicides available under various trade names. The following is a list which includes materials registered and currently available in Canada. It does not constitute an endorsement by the authors of these materials, to the exclusion of similar products. A complete listing of registered turf disease control products is available from Control Products Section, Plant Products Division, Agriculture Canada, Sir John Carling Building, Ottawa, K1A 0C5. Local restrictions may apply to the use of fungicides e.g. the use of mercury fungicides is not permitted in British Columbia or in national parks.

| Common Name                       | Trade Names                                      |
|-----------------------------------|--------------------------------------------------|
| anilazine                         | Dyrene                                           |
| benomyl                           | Benlate, Tersan 1991                             |
| * cadmium chloride                | Caddy Liquid<br>C-A-D Turf Fungicide             |
| captan                            | Orthocide 50 and 80 WP.                          |
| carbathiin                        | Vitavax, carboxin                                |
| chloroneb                         | Demosan, Tersan SP., Scotts Proturf              |
| chlorothalonil                    | Daconil 2787, Foligard, Bravo,<br>Termil, Prosol |
| ** DSF                            | D-D Soil Fumigant, Telone, Vidden                |
| ** DSG                            | Telone Soil Fumigant, Telone II                  |
| iprodione                         | Rovral                                           |
| * fenamiosulf                     | Lesan, Dexon                                     |
| maneb                             | Dithane M-22, Manzate D, Tersan LSR              |
| mercurous and mercuric chloride   | Calo-clor, Merfusan, Mersil                      |
| phenyl mercuric acetate           | PMAS, PMA-10                                     |
| phenyl mercuric acetate + thiram  | Proturf Broad Spectrum Granular<br>Fungicide     |
| oxycarboxin + thiram + carbathiin | Arrest                                           |
| quintozone                        | Terraclor, PCNB                                  |
| thiophanate-methyl                | Easout                                           |
| thiram                            | Plantco Turf Fungicide                           |

**Always observe the instructions given on the package relating to usage and precautions to be taken with the pesticide.**

- \* Fungicides registered for turf diseases but not recommended in this publication.
- \*\* Nematicides

Copies of this publication may be obtained from:

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7000 - 113 Street  
Edmonton, Alberta T6H 5T6  
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